# WASHINGTON MALARIA AND THE "CATCHING COLD."

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Malaria and the catching of cold are undoubted factors in the causation of disease, and the morbid manifestations from both causes are frequently so much alike that differentiation of cause is not always easily made. Physicians as well as laymen constantly mistake the effects of one for those of the other, and the ills that afflict us are oftentimes attributed to the unavoidable and baneful influences of atmospheric contamination, when in fact they are caused by the "catching of cold." In the common language of this locality, the prevalent ailments are called malarial, and believed to be the necessary result of even a temporary sojourn in an atmosphere erroneously supposed to be always charged with noxious exhalations from the marshes of the Potomac and Anacostia Rivers.

No one can deny that the extensive river flats along the eastern and southern boundaries, the sluggish stream forming the western border of the city, and the Chesapeake and Ohio Canal which penetrates the western section, until lately known as Georgetown, which is always laden with débris washed by the storm-water from the streets, and the filthy products of slack-water navigation, present all the conditions necessary to the development of miasmata. Nor will any one excuse the neglect which has not only tolerated these long-standing nuisances, but permitted them to increase to such an extent as to become a disgrace to the National Capital, and the cause of many forms of disease. Nevertheless, the prevalence and certainty of the miasmatic influence does not afford a sufficient explanation of the numerous cases of sickness and indefinable ailments which habit and fashion ascribe to malaria.

Whilst, therefore, admitting the existence of conditions necessary to the production of malarial diseases, and condemning the inexcusable delay in abating these nuisances, my observation and clinical opportunities induce me to doubt that malarious contamination of the atmosphere is the exclusive cause of certain irregular forms of disease which prevail in this city, especially during the autumn and winter seasons.

As yet malaria has not been isolated as a defined element or quantity, recognizable either by chemical reactions or microscopic characters. It is true that Klebs and Thomassi-Crudelli have announced the discovery of a *bacillus malariæ*, but the more recent experimental investigations of Sternberg, relating to the cause of malarial fevers, fail to establish the active agency of these organisms in the causation of them in man, though many circumstances "favor the hypothesis that the etiology, of these fevers is connected either directly or indirectly with the presence of these organisms or their germs in the air and water of malarial localities." Notwithstanding this want of positive knowledge in regard to its true nature, numerous well-known facts and circumstances have established a belief that a poison is generated from decomposing vegetable matter under a combined influence of heat and moisture, which, when introduced into the system, either through the respiratory organs or alimentary tract, will produce certain forms of disease, which vary in intensity, form, and type according to the virulence of the poison, temperature, amount absorbed, and individual susceptibility. For the present discussion this definition of malaria is sufficient, and excludes all other deleterious emanations and morbific agencies, either chemical, gaseous, or parasitic.

The development of this poison is favored by marshes, more especially when containing mixed salt and fresh water and resting on a substratum of limestone, clay, or mud; by swampy, undrained, and delta lands; extensive excavations; newly turned soils; rains after long-continued drought, and consequent low-water level; careless culture of soil; neglect of cultivation where vegetation is luxuriant and is permitted to decay on the surface; and in fact by the requisite combination wherever present of the essential elements—high temperature, moisture, and decomposing vegetable matter. Nor can it be doubted that it may be diffused in the atmosphere and transported by winds and water-courses to non-malarious localities.

The circumstances which hinder or prevent the generation of miasmata are high latitudes, high elevations, drainage, sunlight, sandy or porous soil, and cold; of these cold is the most powerful. The first fall of the temperature below the freezing point in any malarious region arrests the process of development, and it does not recommence until the temperature again ranges continuously during day and night above 58° Fahr. Malarial diseases are rare beyond the sixty-third degree of north latitude and the fifty-seventh degree of south latitude. The nearer the equator from either of these lines the diseases increase in frequency and intensity. These limits are, however, greatly affected by the duration and high average of summer heat. Hirsch has shown that the average summer heat is a more potential influence than the average annual temperature. High elevation presents many curious exceptions, probably depending upon geological formations. Strata of soil or other impermeable geological formations which obstruct or prevent the percolation of the water, and retain it in a loose surface soil or in deeper layers containing decomposing vegetable matter, are frequently the cause in many malarious localities. In such regions subsoil drainage is the only effectual preventive. Sewers, with water-tight conduits (as they ought to be in all cities) for the conveyance of the filth and storm-water, cannot accomplish much towards soil drainage. The cleavage of impermeable strata caused by the necessary excavations may facilitate percolation to a limited extent, but is altogether insufficient in those cities standing upon soils where the conditions exist which render soil drainage necessary.

Miasmata are generated more rapidly and the poison is more intense during night than during sunlight, and a humid atmosphere and rapid evaporation favor its production. Hence the salutary influence of solar light is modified by the moisture of the air, the rapidity of evaporation, and the total movement of the wind.

An analysis of the conditions and circumstances favorable and unfavorable to the generation of miasmata, and their application to this locality lead to the conclusion that this city presents other conditions favorable to the production of miasmata in addition to the constantly increasing river flats, which are so universally condemned as the chief cause of malarial diseases. The city is located in a basin surrounded by a range of hills, broken on the east by the Anacostia River and its damp and swampy lowlands; on the north by Rock Creek; and on the west by the Potomac River, which washes the entire southern boundary of both cities, and emerges from the basin, after uniting with the Anacostia at a sharp bend toward the south, below the flats, leaving along its southern shore an extensive area of swampy land, subject to occasional overflow, and usually, during the summer, covered with luxuriant vegetation under careless cultivation, over which the prevailing southern winds of that season must come. Under the center of the city flows Goose Creek to its sewer connection. This was formerly a tributary of the Tiber, but is now the common sewer of a densely populated portion of the city, quite equal in territorial area to the original drainage limits of this stream. Farther eastward is the Tiber, a large and sluggish stream, which has its source in the hills above the city. It was the main and natural drainage stream of a large part of the northern and northeastern sections of the city, into which several lesser streams, lying wholly within the city limits, empty. After passing the west front of the Capitol park it originally turned abruptly westward and emptied into the Potomac south and west of the Executive Mansion. This part of the stream was diverted by the construction of the Washington City Canal, which occupied its bed from its mouth to the bend before referred to, and from thence extended in a southeasterly direction along the valley at the base of the elevated plateau upon which the Capitol stands. The canal is now replaced by the B-street sewer, running westward to the Potomac from West Sixth street; thence eastward by another sewer connecting at the Botanical Garden with the Tiber Creek sewer, which, from this point, follows the course of the eastern division of the canal to its intersection with the valley of James Creek. Below and southeast of the latter point the canal remains open, and is the common receptacle of the sewage, soil drainage, storm-water, and filth of that neglected section. It was built for commercial and drainage purposes. By its construction (the earth from the excavation having been used for filling) the marshes and low lands, which occupied for the most part the area lying south of Pennsylvania avenue and north of the reservations known as the Mall, have been reclaimed and are now appropriated in part for parks, but mainly for commercial and industrial purposes. Throughout the extent of this reclaimed territory the soil drainage is inadequate. The cellars of the buildings are damp, and constantly subject to overflow by back-water from the Potomac and from heavy rains. During the spring of 1881 Pennsylvania avenue from the Capitol grounds as far west as Tenth street was inundated; and in some places the water reached several feet in depth, and passengers were conveyed to and from the Baltimore and Potomac depot in boats.

Previous to the construction of the storm-water conduit along New York avenue from West Seventh street, down west Fifteenth street, and thence through the grounds south of the President's house to its outlet into the Potomac at the foot of West Seventeenth street, the B-street sewer was the carrier of all the sewage and fall-water from the central and most populous part of the city included within the lines of West Seventh and Seventeenth streets north to Vermont and

Rhode Island avenues. The construction of this conduit was a very important improvement, because of the incapacity of the B-street sewer, and the contemplated diversion to the Boundary intercepting sewer of the rainfall and sewage of the area between West Fourteenth, North N and Boundary streets, will be an additional relief to the sewer mains emptying into the Potomac. In the B-street area, the carriage-ways are, for the most part, paved with concrete and asphalt. Through it runs Goose Creek sewer. Its subsoil drainage is limited to the percolation along the sewer excavations and distribution.

The Tiber to the northern boundary of the city has been arched and converted into a sewer, and now finds its exit into the Anacostia through the recently built open sewer along the bed of James Creek. The area of the Tiber valley system of storm-water drainage and sewerage is very large, extending westward to the east line of the B-street area, north and northeastward along the Boundary-street sewer to its intersection of Maryland avenue, and is bounded on the east and south by Maryland avenue, East Sixth street, and North Carolina avenue to its southern terminus at the crossing of New Jersey avenue and E street south. The sewage, rainfall, and waters of the numerous springs formerly scattered throughout this territory and the tributaries of the Tiber south of the boundary intersecting sewer are carried by the same conduits. The valley of the Tiber and its tributaries originally extended far into the eastern and northern sections, and even beyond the northern limits of the city. It constituted the largest single drainage area in the basin. Within its borders were several marshes covering large areas, notably the localities formerly known as "Swampoodle," the vicinity of the Public Printing Office and St. Aloysius Church, and the larger part of the "slashes." The latter was a long and narrow strip of boggy and swampy land stretching eastward and westward along the base of the hills on the northern frontier, insufficiently drained by two small streams, one now known as Slash-run sewer, emptying into Rock Creek, below the P-street bridge, the other a branch of the Tiber.

It thus appears that the surface of that portion of the floor of the basin upon which Washington now stands was originally traversed by extensive valleys, and that the central and most densely populated part, lying between the Capitol and Rock Creek, was, in fact, an island, surrounded by streams of running water, marshes, and boggy lowlands. Its surface was uneven and irregular, broken by numerous elevations, depressions, and natural drainage courses, either surface or subsoil, which have been mostly obliterated.

The foregoing description of the soil, marshes, running streams, and springs, which were unusually numerous in such a small territory as that included within the city's limits, has been introduced to show that the natural drainage of the subsoil was insufficient, and that consequently there were formed large tracts of marshes and swampy and boggy lands. The conversion of the streams into sewers, with water-tight conduits, has diminished their subsoil drainage capacity, and in fact has limited the soil drainage to the sources of the streams and such additional percolation of water as may take place in the excavations through the earth rammed along the walls of the conduits. How far this disturbance of natural drainage made necessary by the sewerage system may compensate for the innumerable subsoil pores and crevices which must have discharged on either side into the open water-courses cannot be ascertained. It cannot, however, be complete. It is true the conveyance of the storm-water from the surface by grading, paving, and sewerage, the diminution of the open and exposed area by buildings, pavement of streets and sidewalks, and especially by the impermeable pavements, has greatly lessened soil saturation from fall-water. The extent of evaporating surface has also been greatly diminished. Whether these artificial interferences have contributed to the sanitary improvement of the underlying earth is an unsettled problem. A porous soil forming the greater portion of the floor of a great basin, the surface of which, for the most part, is but slightly elevated above the water-level of the great streams lying along three-fourths of its circumference, and at the foot of a range of high hills on the other fourth, must be subject to constant capillary filtration, even to saturation, at a depth not far above the water-level in the contiguous and surrounding rivers. This capillary circulation is increased by high temperature, to which the extensive surface of impermeable asphalt and concrete pavements is probably a very considerable contributor, especially during the season when the solar heat ranges above an endurable temperature. Thus, notwithstanding the diminution of storm-water percolation and superficial area of soil-saturation, conditions are present, during the greater part of the year, which promote the capillary circulation throughout the porous strata. The exposed evaporating surface being lessened by the means before referred to, the exhalations must find their escape mainly through the uncovered parks and spaces, permeable pavements, and cellars, basements, and foundations of houses not protected by concreted floors and cemented walls. The evidence of this constant filtration may be noted at any time (even though no rain has fallen for days or weeks) by comparing the relative dryness of the brick sidewalks on the north and south sides of streets running east and west (most marked at night), and in many localities the same condition is shown by the walls of buildings for several feet above the level of the sidewalk. It is more observable along the streets where the carriage-ways are paved with impermeable material. In the cellars, basements, and ground stories of houses unprotected by impermeable walls and floors the evidences are even more apparent. I will not assert that these emanations are laden with the poison of miasm, but the supposition of its presence is not without some show of reason, inasmuch as heat and moisture are certainly, and decomposing vegetable matter presumably, present, more especially in those localities where the surfaces have been changed by considerable filling. The water which oozes through the system of capillary irrigation may be impregnated, as it is mainly derived from streams that have coursed through many miles of malarious territory. Even if the exhalation is free from miasmatic poison, the increased humidity of the air surrounding and permeating the walls of dwellings and diffused through the apartments of the occupants is unsanitary, and becomes an important and prevalent factor in the causation of the morbid processes incident to the catching of cold, which will be considered further on.

It must not be forgotten also that our summers are long and hot. The temperature throughout the months of June, July, August, and September—some years a month earlier and later—runs continuously during day and night above the elevation necessary for the generation of miasmata, and also that during the months of greatest heat the total movement of the wind is less than during other months of the year—circumstances favorable to a rapid production and concentration of miasmata.

The section of the city west of Rock Creek, formerly known as Georgetown, presents conditions no less favorable to the generation of miasm. It is located upon a slope rapidly ascending from the water-level of the Potomac to an elevation of several hundred feet above the sea-level; is surrounded on three-fourths of its circumference by water, with Analostan Island and its contiguous marshes in front; is penetrated by the Chesapeake and Ohio Canal; its sewerage is insufficient; it is without subsoil drainage, and is closely and compactly built, with streets narrow and insufficient for ventilation and evaporation. The houses are mostly built of brick with unprotected foundations and cellars, and upon a surface with underlying impermeable strata. High above its most populous portion are two large cemeteries, in which the number of interments is daily increasing.

If the result of investigations recently promulgated by Pasteur in his address before the London International Medical Congress should be confirmed, that the germs of disease do not die with the death and burial of the victim, but retain vitality and the power of reproduction for years, the question of the removal of cemeteries beyond the limits and suburbs of cities will soon agitate the popular mind of large municipalities. I would not utter one word which could lessen the love and respect so universally shown to the dead by the protection and embellishment of burial places, but we live for the living and not for the perishable bodies of the dead, from which poisonous emanations may be constantly permeating the earth and be diffused in the air we breath and the water we drink. Cremation is repulsive to our devotional and emotional sensibilities, but may yet become a necessary sanitary reform. Life and health is the sum of all values to the human being.

For cleanliness of its streets and general surface this city is not excelled, if equaled, by any other known to the writer. The admirable system of street sweeping, the smooth pavements, undulating surface, prohibition of deposit of refuse in the streets, and acquiescence of the people in every effort to improve its sanitary condition, contribute to prevent collections of dirt, filth, and foul and extraneous matter in the streets. The garbage department is probably as well executed, and the alleys are kept in better order than is usual in large cities. There are comparatively few localities where masses of squalid and vicious people are huddled in filthy, insufficient, and unfit habitations. There is comparatively little poverty, want, and suffering, notwithstanding the large proportion of indigent and idle negroes. The climate is temperate and salubrious. The plan of the city, with its wide streets and avennes, and its numerous parks and open spaces, affords great protection against the extension and virulence of contagious and infectious diseases.

The escape of sewer gas into private dwellings is one of the most frequent alleged causes of disease. No intelligent physician will deny its deleterious influence. It is a fact, however, in this city, that the greatest number of deaths from zymotic and pulmonary diseases (see maps showing distribution of deaths in the annual reports of the health officer for the years 1879 and 1880) occur in those parts corresponding with the localities of former soil saturation and now deficient soil drainage, as, for instance, the extensive area originally traversed by the valley of the Tiber and its branches, the Slashes, Slash Run and its contiguous lowlands, and that part now known as South Washington. In the latter district the drainage is surface and bad, "many of the gutters do not carry away the storm, slop, and waste water, and it is left to evaporate or find its way into the soil."

Even if sewer gas was not an active agency in the production of disease, it is a nuisance that ought not to be tolerated in any habitable dwelling. In some houses the odor from foul and improperly cleansed fixed wash-stands, water-closets, privies, and insufficiently ventilated rooms is mistaken for sewer gas; nevertheless in many others the air is rendered impure and unhealthy by its admixture with sewer emanations. This is most usually due to the imperfect plumbing and house drainage, and not to defects in the system and construction of the sewer mains. The rainfall and sewage are car-

ried off in the same conduits, and "the principal main sewers (see Lieutenant Hoxie's report, 1880), following the line of natural drainage," discharge at intervals along the water front, thus securing diffusion and dilution of the sewage. The combination of the systems of sewage and storm-water drainage, and the transference of the running streams into the same conduits, promote constant agitation and admixture with pure water, and a more rapid conveyance and greater aeration of the sewage, thereby diminishing the generation and promoting the innocuousness of the gases. Lieutenant Hoxie says "nearly all the gas not due to defective plumbing in houses is generated in the tidal sections of" the principal main sewers. He believes "the motion of the tides driving back these gases at the flood" is advantageous, inasmuch as it induces motion, and promotes their withdrawal and replacement by fresh air. The oval "shape of the sewers concentrates (Hoxie) the dry-weather flow in the invert, and the large air space above is favorable to a prompt oxidation of such gases as may form during the short time occupied in flowing to tide water." Ventilation is effected by grated manholes at short intervals. The chief defect of the system is, perhaps, the deficient fall of the sewer mains. This is partially, if not wholly, compensated for by the combination of the two systems. It is believed that if the engineer department could be clothed with authority to adopt, free from the trammels of individual and speculative interests, and be supplied with funds sufficient to execute a plan of improvement and extension, the sewerage of this city would be as complete as possible, and far in advance of that of most large cities. Even in its present unfinished condition it must be admitted that the constantly alleged danger from escape of the gases into private dwellings is overstated, except so far as it is due to faulty plumbing and house drainage, defects not attributable to the general plan or to the engineer department, but directly chargeable to the negligence of the owners and builders of the houses. This evil can only be corrected by the vigilance and supervision of the health department, which has several times invoked the necessary authority, but as yet without securing the assent of Congress. Such emanations, though productive of disease, do not often cause malarial diseases. Typhoid fever and diphtheria most frequently, probably, find their origin in this manner.

If not demonstrated, it is very generally believed that the soil of malarious regions contains the malarious poison in great quantity, even during the season when malarial diseases do not affect human beings. It is also believed, and medical topography supplies abundant affirmative testimony, that moist subsoils, with surfaces exposed to high temperatures and rapid evaporation, present all the conditions necessary for the generation of this poison. In such places the ground air may become contaminated and the poison may be gathered in the strata of air near or on the surface. Nature's method of drainage is by streams and rivers. Ground water seeks the level of the drainage streams. Rivers receive the waters of their tributaries, the tributaries of the lesser streams, each of which is the confluent of smaller branches, until we reach the rills and rivulets which are formed by the storm-water which penetrates the earth and percolates through the interstices and pore canals. The rainfall flows from the surface towards the sea. The larger and smaller streams drain larger and smaller areas; these areas are interspersed, more or less, with uplands and lowlands, hills and valleys, mountains and plains, prairies and forests, and arid and swampy lands. Every such tract, however small, has its natural drainage course; it may be a mere depression of the surface, a running rill or a majestic river. As the larger are made of the waters of the smaller streams flowing from sources of varying elevation, even up to the plane of the pore canal, so must the height of soil saturation of the different parts of a given area vary with the water-level of its drainage course, but it can never sink below the plane of the nearest running and never-failing stream, and will always be affected by the frequency and amount of precipitation, the nature of the strata of the earth, and the slope of the watershed. The Potomac and Anacostia Rivers, which wash the shores of this great basin, fix the plane below which soil saturation can never sink. This, in many places, is but a few feet below the natural surface. But, because of the nature of the geological strata and other peculiarities of the situation, there are numerous localities where the point of soil saturation is far above the plane thus established and so near the surface as to be reached by the excavations necessary for building purposes. The preceding description of the original topography points out such parts, marked by depressions, marshes, swamps, springs, and surface streams; the maps of the health department, showing the distribution of deaths from certain diseases, prove the unhygienic condition of such situations and their unfitness for purposes of habitation. The diminution of the superficial area of storm-water percolation has certainly lessened the amount of ground water, and the construction of water-tight conduits has facilitated the conveyance of the surface water to the river channels. While the transfer of the drainage streams to the sewers has its advantages, it is, nevertheless, manifest that such conduits are not subsoil drains, and that the modes of escape of the ground water, especially in certain parts, are wholly inadequate for sanitary purposes. The filling of depressed parts, and the attempt of the late board of public works to reduce the surface of the basin to a common level, have obliterated unsightly ponds and marshy lowlands, but have not lowered the plane of soil saturation. In fact, in many places the distance between the surface and this plane has been diminished, as may be seen after seasons of wet weather, when whole squares of unoccupied ground are submerged and adjacent cellars, basements, and foundations are inundated by soil water. This is more constantly observed in the localities of former marshes and places insufficiently drained previous to any artificial disturbance of the natural topography, and where the natural drainage has been transferred to the sewer mains, and such precolations as may take place along the excavations. To correct these natural unsanitary conditions, and to remove the obstructions interposed both by nature and art, is a matter of grave interest to the permanent population and to the national Government. As the general surface of the floor of the basin is but little above the elevation of the tidal wave, it is not probable that engineering skill will ever successfully obviate all of the obstacles presented, but there can be no doubt of the value and practicability of a system of subsoil drainage which will lower the subsoil saturation throughout those parts of the territorial area where it is made necessary by the geological structure and artificial interference. That such a system will contribute greatly to the mitigation of the natural defects and promote the healthfulness of the city there can be no doubt, as is illustrated in the improved sanitary condition of certain towns and cities in England where the subsoil has been effectively drained. As shown on the maps previously referred to, and demonstrated by Dr. H. I. Bowditch, of Boston, by observations made throughout the State of Massachusetts, pulmonary consumption bears a positive and constant relation to soil saturation. The same fact has been shown in England by a series of observations made under the direction of Mr. Simon, by Dr. Buchanan; and the additional fact, also, that this disease had decreased in those towns after the drainage of the subsoil, most markedly so in those where the level of subsoil saturation was most lowered. Dr. Mead, the medical sanitary inspector of this city, makes the emphatic statement (report of health officer for 1880) that in certain localities in this city where better drainage has been secured a marked decrease has taken place in the number of deaths from phthisis, acute respiratory and diarrheal diseases. The city of Detroit was built upon a low and wet soil, and it was a very sickly town, but since the improvement in the drainage it has become one of the healthiest cities in the country. Dr. Elliot has shown that in New Orleans, in which city there is constantly present the condition of excessive soil moisture, the mortality from pulmonary consumption for the years 1869 to 1879, inclusive, nearly doubled that of either yellow fever, malarial fever, or diarrheal diseases, and that the excess of deaths from that disease occurred during the six warmer months of the year.

Ground-air (*) is perhaps neither a less potential nor a less frequent factor than ground-water in the causation of disease. The popular belief is that the atmosphere ends where the ground begins, but the fact is that the pores of the earth when not filled with water are filled with air. The quantity varies according to the nature of the soil. The greater its porosity the more air it can contain. Rubble soil, gravel, or sand will hold about 35 per cent. of its mass of air. The degree of humidity of a soil represents the amount of ground-water, and soil saturation begins at the lowest limit of the air. Ground-air contains a larger proportion of carbonic acid than either the atmosphere or the ground-water, and, at a few feet below the surface, even more than is usually found in badly ventilated dwellings. The quantity is greater during winter than summer, and increases with the depth, except during the months of June and July, when the percentage is inversed. Pettenkoffer concludes from his investigations that the soil is the source of this gas, and is yielded by it to the ground-water and ground-air, most freely to the latter; and he believes that it finds its origin in organic processes taking place in the soil. Huxley, Haeckel, and others have shown that organic life exists everywhere in every porous soil, as well as at the bottom of the sea. The more porous the soil, the greater the quantity and more rapid the diffusion of air; the more active the processes of decay and putrefaction, the greater the development of low organisms and the more abundant underground life. The ground is not only permeable, but the air it contains is in constant motion, produced by the pressure of the atmosphere and wind against the surface; by differences of temperature; by any and every cause which can produce movement; and by the general law of diffusion of gases. The leakage of coal gas from street mains has frequently been known to permeate the earth beneath the street, penetrate walls, vaults, and foundations, and escape into dwellings at considerable distances from the leak. So, also, has the poison of disease been transported by underground conveyance. Whatever impurities and pollutions may contaminate the ground-air will be diffused by the current and constant change going on. It may be impregnated with noxious emanations generated either on or below the surface. All forms of filth, the excreta of animals, and the processes and products of putrefaction collected upon or under the surface, or deposited in vaults, cesspools, or pits, constitute foci from which deleterious exhalations are disseminated throughout the ground. In cities and other places where people are massed in large numbers in circumscribed areas, the soil-water and ground-air will be, to a great degree, unfitted for

*These data have been summarized from Pettenkoffer's lecture on "The relation of the air to the soil or ground-air."

the purposes of human life by such poisonous and, oftentimes, disease-bearing effluvia. They are more detrimental to life when received into the system through the ground-air than when conveyed through the atmosphere, because more concentrated, and mixed with larger percentages of carbonic-acid gas. When exhaled into the free atmosphere they are more easily diffused and diluted, are blown away by the winds, and, probably, more speedily oxidized and rendered inert. But how can the ground-air reach us? Currents are created by differences of temperature, and will be in the direction of the higher. It should then constantly oscillate up and down toward the atmosphere and into the earth. Fortunately for human life it does this, and in the process the earth is ventilated, and the deleterious constituents of the ground-air are diffused into space. But this movement and change of air between the atmosphere and the earth is only partial, and is influenced by many conditions and circumstances, such as the currents and force of the wind; formation of the soil; amount and frequency of precipitations; degree of soil humidity, and depth of soil saturation. It comes to us when least expected, and when least resistance can be offered to its influences. It comes with high percentage of carbonic-acid gas, with relatively high humidity, and, perhaps, laden with the germs of disease. It comes in our dwellings, in our sleeping apartments, during the hours of rest and repose, and is most apt to do so when we are most securely protecting ourselves from the external atmosphere, either because we fear its injurious contaminations or its chilling influences. It comes under the surface, passes through the earth, and the permeable walls, foundations, and floors of our houses, and poisons the air we breathe. Every house unprotected by foundations and walls impermeable below the surface is a draft-flue for the earth. The penetration of the air through the earth is promoted and facilitated by every such house. The warmer the air inside, and the more securely protected against the external and free atmosphere, the more rapid the current of ground-air through the foundations and ground floors of such dwellings. It is a more constant evil during the colder than during the warmer seasons, because of the greater difference between the temperature of the houses and of the ground-air. Freezing of the surface offers but little obstruction to the circulation of ground-air, and none at all to its horizontal movement. In fact it has been supposed by some to favor its escape into dwellings and through the warmer surfaces. No explanation entirely satisfactory has yet been presented for the greater prevalence and intenser forms of small-pox, scarlet fever, and other exanthematous diseases during the colder than during the warmer seasons. The greater number of persons in, and the more constant occupancy and diminished ventilation of dwellings are admitted and important agencies. Why may not the ground-air, carrying these contagions and penetrating these dwellings, prove a factor in their dissemination equally as constant and potential? If it be a fact, as announced by Klebs and Thomassi-Crudelli, that the malarial poison is found in the soil of malarious regions during the seasons when the temperature of the atmosphere is below that believed to be necessary for the generation of this miasma, why may not the greater facility and certainty of the admission of ground-air into houses at such times explain the prevalence and constantly recurring attacks of malarial diseases during these periods? The fact is easily demonstrated that many occupants of houses standing upon made or insufficiently drained lands are sufferers from persistent and ill-defined ailments, from which relief is only secured by change of dwelling. And, surely, if the discoveries announced by Pasteur have any substantial basis, the conveyance of the germs of disease in this manner is not only possible but probable. It may not be practicable to prevent entirely the pollution of the ground-air, but it can be reduced to a minimum, and the air of dwellings can be securely protected from such contamination by proper construction. Greater cleanliness of the soil can be secured by the prohibition of cess-pools, privy boxes, and pits, and of other collections and deposits of decaying and putrescible material, either upon or beneath its surface. A properly arranged and adequate system of sewerage, and compulsory legislation requiring a connection with every such depository and receptacle will accomplish much in preventing soil filth. A system of underground drainage will dispose of the surplus soil-water, lower the level of soil situation, and purify the earth by promoting ventilation and a more rapid percolation of the rainfall to greater depths. The pipes of such a system when not carrying water will carry air, and thus aeration and ablution of the soil, and dilution and diffusion of the filth will accomplish at least a partial disinfection.

The air of dwellings must be considered in its relation to the surrounding atmosphere as well as to the ground-air. This relates especially to the study of the processes of catching cold. The air of a dwelling cannot be purer than the atmosphere which surrounds it, and is altered (Pettenkoffer) and deteriorated by whatever goes on in it. It is polluted by the admixture of substances, and altered in chemical composition after it enters the house. Oxygen is consumed by respiration, lights, and fires. Carbonic acid and water are exhaled from the lungs and skin, and various other extraneous matters are derived from the uncleanly and careless management and disposal of the waste and refuse. These alterations are partly unavoidable. Interchange is constantly taking place between the air outside and inside. No house can be protected against this change of air, and if the atmosphere was excluded it would not be habitable. Ventilation is, however, in very many habitations insufficient, because of overcrowding, defects of construction, and neglect of preventable sources of pollution; and it is a great waste to consume fresh air in the aeration and dispersion of such unavoidable contaminations.

The air, both inside and outside of dwellings, is always in motion, though this is not always manifest to our senses. Ventilation is effected by the constant interchange due to motion produced by differences of temperature and by the force of the wind, and is regulated by the porosity of the walls and the size and number of the apertures and architectural openings. The difference of temperature and the force of the wind frequently supply the insufficiency of the one or the other. By these means spontaneous ventilation ought to be sufficient for the purposes of health, provided the greatest cleanliness and abstention from superfluous pollutions are observed.

There are, however, many circumstances and conditions which interrupt and impede this necessary and wholesome interchange. In this city damp and wet walls are among the most frequent disturbances of ventilation. Water fills the pores of the brick, stone, and mortar, and closes the inlets and outlets of these porous materials so generally used in the building of houses. This water is mainly derived, through the permeable foundations, from the ground-water, which in so many places is excessive and near the surface. But damp walls not only prevent the passage of air, but disturb the heat economy of the bodies of the dwellers. Water is a better conductor of heat than air, and wet clothes are colder than dry. Wet walls abstract and absorb more heat than dry walls. They reduce the temperature of the room and accelerate the loss of animal heat, thus producing a too rapid cooling of the whole or parts of the body. In this circumstance many cases of sickness find their cause. Colds, catarrhal inflammations, rheumatisms, and kindney diseases (prevalent forms in this city) are quite common among the occupants of damp dwellings.

Ventilation and draught are not the same. Both imply motion of the air. Ventilation is the necessary change of air in a closed space taking place without perception of its movement. Draught is the motion of air made manifest to sensation, and differs from wind only in force and velocity. The occupants of wet and damp houses frequently complain of and ascribe their ailments to draught, when in fact there is insufficient exchange of inside and outside air, because of the filling of the pores of the walls with water. In addition to vitiation of the air in such houses, there is more rapid absorption of heat and lowering of the temperature, causing local and one-sided radiation of the body-heat and the consequent disturbances of the heat-economy, thus producing ailments which are ascribed to malaria.

In whatever respect soil saturation may be considered, its influences and effects are detrimental to health. Agriculturists have long since recognized the injury of surplus soil moisture to plant life, and experience has shown that such lands, usually the richest in the elements of plant food, can only be made available by underdrainage. But not until recently, and only by comparatively few even now, have its dangers to human health and life been clearly understood. Only by the study of the topographical distribution of diseases and deaths has the direct connection between soil saturation and pulmonary consumption been ascertained. And though shown to be true in regard to large regions and sections, but few are yet willing to believe it equally true of single habitations. Until the doctrine that diseases are more frequently attributable to personal and domiciliary unhygienic conditions than to natural causes is more universally accepted, but little can be accomplished by preventive medicine.

Morbility and mortality bear a constant relation to the density of population. This is a factor in all cities. When to a superabundant and unclean population are added the effects of an inadequate provision for the removal of the various excreta, the air becomes permanently laden with noxious elements. This is a city for politics, æsthetics, and the sciences, and not for commercial and industrial, pursuits, and hence ought to be comparatively free from many foul matters and effluvia, which are the unavoidable accessories of the latter occupations. The plan of the city secures constant agitation of the air and free ventilation. Its wide streets and broad avenues with their numerous intersections forming large open spaces, create interchanging currents. These, together with the large area of public reservations, promote the diffusion, dilution, and escape of the insalubrious and detrimental exhalations. As a cause of disease the density of the population can never become, as in more populous cities, the predominating influence. The area of unoccupied territory will always be largely in excess of the occupied. Nevertheless, as the value of real estate advances, the cupidity of owners will, in small districts or single squares, unless restrained by law, establish numerous foci for the germination and dissemination of infectious germs by the subdivision of lots, the opening of new streets, the conversion of alleys into others, and the erection of tenement-houses upon every available space. I might even now cite such localities. The proper adjustment of the number of residents to the area, together with the rigorous enforcement of sanitary regulations, would greatly lessen the morbility and mortality, especially in those districts where overcrowding and filth prevail. It is a great mistake to suppose that we have no personal concern in nuisances

on neighbors' premises They can poison the ground, air, water, and atmosphere, and this poisoned air may permeate the earth and convey to other dwellings the germs of disease. Our senses may not detect the noxious effluvia, but the enemy may find its victim all the same.

It may be asked, how abate the evils complained of? The answer is easy. Reclaim the river flats; complete the system of storm-water conveyance and city sewerage; hasten to completion the grading and improvement of the streets; elevate the bed of Pennsylvania avenue from the Capitol to west Fifteenth street; discontinue the use of impermeable material in the pavement of carriage ways and sidewalks; establish and execute a system of subsoil drainage; obliterate or subsoil the parks along the building lines; improve and adorn the reservations; extend the Capitol park south to the river shore and connect it with the reclaimed flats along the Potomac; prohibit by stringent regulations the erection of buildings with permeable ground or underground floors and walls below the surface of the streets; straighten the channel of Rock Creek, by cutting across the horseshoe bend at P street; hide its filthy shore by an arch, and open a park along its course; and empty the Chesapeake and Ohio Canal into the Potomac above the limits of Georgetown, and destroy the unsightly observation of this cesspool of filthy water and many stenches.*

This is the capital of a great, growing, and prosperous nation, beautiful in design, and susceptible of greater and more magnificent embellishments. Every citizen shares the wish for its substantial improvement and adornment commensurate with its importance and capabilities. The time may not be very remote, and will be hastened by the speedy execution of the necessary sanitary reforms, when the surrounding elevations will be covered with winter residences and summer villas, rivaling in beauty and grandeur the taste and display exhibited along the cliffs at Newport. Under the present form of government the sanitary condition has been greatly improved, but this great nation cannot afford to permit the longer continuance of the manifest and admitted causes of disease, which environ and underlie its capital, furnishing a constant menace to the health and lives of its chosen agents and legislators. Nor should the permanent residents stand by idle and unconcerned, while the rising generations are growing up under the baneful and enervating influences, with their multiform phases of disease, interrupted development and broken constitutions. The expenditure required to complete the necessary sanitary reform, under the direction of the most skillful supervision would be a magnificent contribution by a nation of fifty millions of people to sanitary science, preventive medicine, and the welfare of a common humanity.

In the foregoing I have endeavored to set forth the natural and artificial unhygienic conditions of this locality, and have indicated in the title that I ascribe the prevalence of two classes of disease to these causes, one being due to the contamination of the air with a special poison, and the other to the catching of cold. I have also stated that the clinical pictures frequently presented by cases and forms of these different classes of diseases were so alike that differentiation of cause, so necessary for success in treatment, was not always easily arrived at. I approach the discussion of the clinical branch of the subject with diffidence, because I am well aware that the conclusions to which my studies have led me will antagonize the opinions of some of my most distinguished professional brothers; nevertheless I have no new theories to promulgate, and will confine myself solely to the narration of my own clinical observations.

The detrimental influences which environ our population do not belong exclusively to this locality. One could not travel far in any direction from this center without finding other communities no less unfortunately situated. Many cities, towns, and neighborhoods throughout the land present natural conditions equally and even more unsafe to health and life, and exhibit graver errors in hygiene, which yield annually a richer harvest in deaths than we have as yet offered. But if others have suffered more or less, it is no reason why we should delay in securing all that science can promise in the prevention of disease. To accomplish this we must first ascertain the cause or causes. If in the preceding picture I have depicted the work of nature and operations of man in their proper colors, I may hope to interest those concerned sufficiently to arouse them to the dangers which beset the present and may befall future generations, and will have discharged a duty which professional observation, experience, and opportunities have imposed.

Of the presence in this locality of the two causes and two classes of disease referred to there can be no doubt. But our knowledge of the nature and infectious quality of the malarial poison does not permit an exact determination of the relation of this agency to the effects ascribed to it. We witness certain results in constant association and connection with an unbroken chain of known conditions and circumstances, and from these data deduce an hypothesis which affords a reasonable explanation. This hypothesis involves two unascertained quantities, the genesis and *modus operandi* of miasma.

The "catching of cold," induced by the unusual removal of animal heat, either through the external or internal surface, has long been recognized as an etiological factor. The functions of heat production and dissipation are regulated by nerve centers. In health, the equilibrium is maintained within certain physiological limits, and though the temperature of the body is subject to frequent fluctuations within these limits the changes are speedily equalized. The temperature of all parts of the same body is not uniform at the same time, owing to the different amount of heat carried by the blood to the various parts, to the varying conductivity of tissues, and the difference in local production and loss of heat; but a normal range is preserved in health, though between lesser maxima and minima in parts remote from than in those parts near the heat-regulating centers. Heat production is increased by muscular effort, lessened by rest, and least during sleep. The increased production must be compensated by increased loss, and the lessened production by greater protection of the body, else the heat-economy becomes disturbed and injury ensues, affecting either the whole or a portion of the body. The body loses heat by radiation, conduction, and evaporation, which may be influenced unfavorably by external and internal agencies. The external influences may be expressed in low temperature, motion of the air, and moisture. Either may prove sufficient, but disorder more certainly follows their combined influence. It is not necessary that either or all should be of maximum intensity, for slight cooling of the surface by constant change of surrounding air, increased evaporation from the skin moistened perspiration, or increased conduction, promoted by a cooler medium in contact, does in numerous instances produce some one of this group of maladies. Nor is it required that the whole surface should be cooled; a leg or arm, the head or back of the neck may be sufficient. Numbers of persons have felt the pangs of toothache rekindled by a puff of cold air upon the cheek over a decayed tooth, or contracted a cold in the head from cutting off the hair in cold weather, or a bronchitis from wetting the feet, even in midsummer. While it is usual that the part contiguous to the chilled surface suffers, it is not the invariable law. The place or part of least resistence, the weaker organ or tissue, though remote from the part exposed to the chilling, will frequently exhibit the injury sustained. Subject a number of persons of equal age and vigor and of average health to the same cooling influence, one will escape unhurt, another with a slight sore throat, a third will suffer a severe rheumatism, a fourth will pass the ordeal of an acute pneumonia, and a fifth will succumb to a pleurisy, the localization in each case depending upon individual susceptibility and the lesser resistance of different parts. If, says Seitz, a sensory nerve tract be implicated, rheumatic pains or neuralgia may follow; should the vasomotor center be involved, congestion of a special vascular area may ensue; inflammatory processes may be ascribed to the transfer of the impression to the nutritive nerves, and if the heat-regulating center be depressed fever may result. It is not necessary that the surface refrigeration should be long continued. The sudden transition from a warm to a cool medium, as the passing from an overheated room to a cold entrance hall, or into a strong current, even though the change be of momentary duration, will suffice in a susceptible person, or a person otherwise healthy, who may be the unfortunate possessor of a locus minoris resistentiæ. It is, nevertheless, a fact that few can resist the influence of an active and protracted loss of body heat. When at rest or during sleep, surface cooling is more certainly and quickly injurious than during exercise, because the loss of heat, even though it may not be manifest to our senses, is not compensated by increased production. During exercise the circulation of the blood is stimulated and surface heat is maintained, but if perspiration is induced evaporation is increased, and this contributes to a more rapid cooling, especially if the exercise is followed by sudden rest, and the cooling is promoted by the removal of overgarments, and the rest he sought in currents of air. Nor is it necessary that the sufferer should be admonished by a rigor. The cases of sickness following loss of heat are more frequent without than with the occurrence of a chill, and it is this class of disorders which is so prone to assume chronic and masked forms, finally developing either into intractable or incurable diseases. A bronchial catarrh, especially in one inheriting the predisposition to phthisis pulmonalis, so trifling as not to attract attention, may leave hidden in the lung structure a caseous focus too small to be recognized and located, but which by constant accretions from subsequent equally trivial and repeated attacks, each succeeding one the more probable because of one or more having preceded, until finally the caseous formations break down, and the previous unsuspected disease passes beyond recovery. This chain of unrecognized beginning, imperceptible progress, and final explosion may have had its cause in constantly repeated slight surface coolings during rest and sleep, in apartments securely protected against wind and storm, but surrounded by walls resting upon soil saturated with water. The early history of such a case is usually that of enfeebled health, with recurring losses and gains, trivial discomforts, passing indisposition, unusual susceptibility to atmospheric changes, digestive irregularities, summer improvements and winter relapses, and gradual but progressive blood changes, marked, in the further progress, by anæmic and masked disorders of graver import, all of which are frequently ascribed to malarial contamination, and the methods of prevention and cure, based upon a mistaken cause, promote and aggravate the morbid processes. The respiratory are not the only organs which suffer from equally slight surface coolings. The alimentary tract is quite as

* These additions, with the Monument grounds, Mall, and Botanic Garden, would make an immense national park and pleasure ground, encircling South Washington, and extending from the Capitol to the Executive Mansion.

often affected, and among very young children the mortality from this group of maladies is even larger than from diseases of the respiratory organs. No one can doubt the agency of sudden refrigeration in producing catarrh of the mucous membranes; and the complex conditions of alimentation and digestion, which so constantly imperil the life of infants at all seasons of the year, exposes the alimentary tract especially to the detrimental influences of sudden loss of body heat. In those cities throughout the climatic region of this country where infantile diarrheas are most prevalent and fatal, the fluctuations of temperature during the summer season are most acute and intense, and there seems to be a correspondence between the percentages of mortality and the frequency and violence of the sudden falls of temperature.* In this city the maps showing the topographic distribution of deaths show a constant connection between the number of deaths from diarrheal disease and inadequate soil drainage. The causes of attacks of cold are not, however, limited to the unavoidable depressions of the temperature of the atmosphere, excessive soil moisture, wet cellars and foundations, and damp sleeping apartments. The mother or nurse will insist that the child could not have taken cold because it was well wrapped when taken out, or was in a carriage with all the windows closed, or had not been out for several days, but had been kept in a thoroughly warmed room. In the closest and warmest rooms there are draughts. The hotter the fire in the grate the stronger the draughts converging from the various openings toward the chimney. Usually they are strongest near the floor, the cold air finding entrance through the spaces about the doors and windows. In an over-heated room the child may have been confined and passed the greater part of the day playing on the floor, exposing first one and then another heated and moist surface to the draughts traversing the floor; or it may have been out on a long walk clad with unusual care and too warmly, and immediately upon returning, fatigued and perspiring, its outer garments had been removed, and it had rested quietly or slept; or the infant, rolled up in cloaks and furs, may have been carried out closely hugged in the arms of the nurse, from whose body additional heat was supplied. On returning, asleep, and moist all over, its outer wrappings were quickly removed, and the child placed to sleep in the crib. In either case a notable and rapid cooling would take place, and the detrimental effect may be quickly exhibited in a sore throat, an earache, a rapidly developed fever, or during the night by croup, or the next day by a nasal, intestinal, or bronchial catarrh, or, even worse, a pneumonia.

The defined forms of malarial disease belong to the class of intermittent and remittent fevers, and the indefinite forms comprehend many of the neuralgic, gastro-intestinal, anæmic, and masked affections. The febrile conditions are usually easily distinguished by their forms and course. It is, however, a well-known fact that in malarious regions many diseases to which malaria bears no casual relation frequently exhibit disturbing perturbations, in great variety, due to its detrimental influence. It is also a recognized fact that in such localities the catching of cold will produce, in those who have previously suffered, relapses and recurrent attacks, and will hasten and promote the development of some form of malarial disease in those in whom the poison may have, apparently, remained dormant. These circumstances long ago led to the hypothesis, which has been occasionally revived, that the diseases ascribed to marsh miasm were due to the disturbances of the heat economy caused by temperature changes; that malaria was nothing more than the sudden chilling of the body previously subjected to a continuous high temperature. The few advocates of this theory have not submitted it to a crucial test, but have mainly relied upon the discrepancies in the testimony in support of the generation and absorption of a miasm, and the aberrant occurrences of paroxysmal fever under circumstances and in localities where the casual relation of miasm could not only not be established, but seemed to be negatived by the environment. It is undoubtedly true that many cases have appeared at places and times which, either because of lack of knowledge in regard to the development and dissemination of the poison or of omissions in the clinical histories of the cases, could not be accounted for upon, or reconciled with, the facts believed to be established in regard to miasmatic contamination. But as yet there is no instance of malarial fever, as understood by physicians, having been produced in a person known to be free from the poison, either at sea, † away from the reach of the land breezes, on high altitudes, or in situations exempt and sufficiently remote from the sources of generation, by temperature changes, however sudden, violent, and frequent their occurrence. This theory is, furthermore, distinctly contradicted by the widespread prevalence of malarial diseases during those seasons and in those places where the conditions necessary for the generation of miasm are known to be present, as well in those places subject to small as in those subject to larger ranges of temperature; by the invasion of sections previously exempt, where artificial disturbances of the natural topography or long-continued occupancy and cultivation may have supplied the needed element, but where the conditions of temperature do not now differ from those in times past; by the greater prevalence and more intense forms as the equator is approached, where the temperature is more uniformly high, the diurnal changes less marked, and the total movement of the wind is small; by the marked variations in prevalence in different years in well-known malarious regions subject annually to the same, or, at most, but inappreciable differences of thermal conditions, but characterized by larger areas of soil upheaval and by greater exposure of miasmatic foci; by the comparative protection afforded by intervening hedges and groves to the occupants of dwellings which, like others, are situated in close proximity to marshes and subject to like conditions and changes of temperature;* by the lesser prevalence, under similar climatic influences, along the bold shores of large bodies of running water than along the delta, boggy, and low lands of smaller streams with far less evaporating surfaces; by the influence of different exposures of human habitations to the prevailing winds in malarious districts, the occupants of those exposed to the direct current of the wind will suffer more than those of the dwellings sheltered by position or otherwise; and, lastly, by the well-known fact that the inhabitants of the territory contiguous to malarious marshes, swamps, ponds, and rivers suffer less in those seasons when such places are filled or overflowing with water, when the thermo-hygrometric conditions are most pronounced, than during those seasons when only partially filled and more or less of their area, covered, as it usually is, with luxuriant growth and decaying and decomposing vegetable matter, is exposed to high temperature, moisture, and soil conditions favorable to the generation of miasm. These and many other facts are inexplicable, except upon the assumption of the generation of a miasmatic poison.

The theory that malarial diseases find their cause in changes of temperature involves the negation of all the data in support of the doctrine of miasm, and necessarily traces to a common cause and pathology the classes of maladies believed to be due to the absorption of this poison, and those believed to be due to the catching of cold. Chilling of the body and the entrance of a poison into the system are different processes. Chill is a common but not a constant initial symptom of malarial diseases. The chill of a miasmatic ague is not the algor of refrigeration. The former is the cold stage of paroxysmal fever, the latter the shock of heat loss. The onset of one is marked by elevation of body temperature, of the other by rapid cooling of the whole or a part of the body. One begins with increased production, the other with increased loss, of body heat. In one the equilibrium of body heat is disturbed by overproduction, in the other by increased loss of heat. How miasm introduced into the system produces fever, or why too rapid cooling of the body is followed by fever, are as yet unsolved problems. The phenomena attending the advent and development of miasmatic fevers denote disturbances produced by a poison acting through the blood, which are expressed in derangements of nutrition, sensation, secretion, physical and mental activity, and in consumption of tissue and loss of body weight. The phenomena following the catching of cold indicate a febrile reaction due to peripheral irritation, and are usually associated with, or caused by, local inflammations. The essential element of fever is increased production of animal heat. Without it fever cannot exist. Wood defines fever to be "simply a state in which a depressing poison, or a depressing peripheral irritation acts upon the nervous system, which regulates the production and dissipation of animal heat." It seems probable, as has been shown by Billroth and others, that inflammatory fevers are due to the absorption of some product of inflammation; nevertheless there are many fevers so trifling that such a grave lesion as blood-poisoning would seem to be precluded. Their provocation by irritation of peripheral nerves would appear more probable, yet with the progress of experimentation the irritative forms of fever are gradually yielding to the proof of toxæmic conditions. As the effect of the refrigeration of the whole or of a part of the body is so constantly exhibited in localized inflammatory processes, if further research and experimentation shall establish the connection of the symptomatic fever of these inflammations with the absorption of their products, the sharp lines of a distinct and definite pathology will be drawn between the primary fevers of malarial origin and the secondary fevers of refrigeration.

Notwithstanding our limited knowledge in regard to the *modus operandi* of these elements of cause, the differential diagnosis between the defined forms of these two classes of disease can usually be made

* Mortality of Young Children; its causes and prevention. By the Author. Sanitary care and treatment of children and their diseases.

† Sir Gilbert Blane, in speaking of bilious remittent fever, says: "I have known a hundred yards in a roadstead make a difference in the health of a ship at anchor by her being under the lee of marshes in one situation, and not in another. It is difficult to ascertain how far the influence of vapors from woods and marshes extends, but there is reason to think that it is to a very small distance. When the ships watered at Rock Fort they found that if they anchored close to the shore, so as to smell the land air, the health of the men was affected, but upon removing two cables' length no inconvenience was perceived. (Treatise on Fevers, Bartlett, page 395.)

*Of the many recorded illustrations, the following may be cited: "Mr. P. E. had negro quarters situated on the first prairie elevation above the low grounds of a small creek, the fourth of a mile from the houses. This belt of low ground frequently overflowed, causing water to remain in holes over its entire breadth on the subsidence of the stream; but it was well shaded by a dense foliage, the plantation lying on a prairie in the rear of the cabins. In the winter of 1842 and 1843 the trees between the houses and creek were cleared away, and up to that time, some eight or ten years, the negroes living in this quarter had enjoyed uninterrupted health, a case of fever scarcely ever occurring. During the summer of 1843, the first after the forest had been cleared away, fever prevailed among the negroes with great violence, continuing until frost. The negro quarters were afterwards removed to the opposite side of the creek, about the same distance from it, but with an intervening growth of timber, and no fever has occurred on the place since." (Treatise on Fevers, Bartlett, page 395.)

at a glance. The conditions of the climate, season, endemic constitution of the locality, initial phenomena, and mode of onset are usually sufficient to determine the presence or absence of malarial infection. In the further progress of the case the paroxysmal character, distinct periodicity, or tendency thereto, type, form, and course of the fever, together with the enlargement of the spleen and liver, and appearance of pigment in the circulatory system and many organs, constitute important and usually decisive conditions.

It is not always easy to determine when or how one catches cold. The exposure may not have been accompanied with manifest chilling; it may have been prolonged, or may have been frequently repeated. It may have occurred during continuous inclement weather, or may have been caused by the abandonment or change of articles of clothing. An attack of cold may be ushered in with high fever, quickly followed by localized inflammation of a catarrhal or rheumatic character, or the fever may follow the development of a local inflammation. This reactionary fever may be out of proportion to the extent of the local mischief, or a simple feverishness. The fever may be unattended by any local disease, but characterized by general malaise, languor, vague and shifting pains and aches, shivering and chilly sensations, cold feet and hands. The chilly sensations may yield to warmth, but will recur upon contact of colder temperature. The patient may be warm in bed, and, upon exposure of a leg, or turning over upon an unwarmed part, a shiver will start up from the limb exposed, or the part in contact with the cooler surface, and run over the entire body, impressing itself most usually with greatest force upon the back and lower limbs. There is also, especially in the milder cases, a tendency to sweat. Complaint is frequently made of alternate sweatings and feverishness, of muscular soreness, especially upon changing from a position which has been maintained for some time, but which disappears gradually during motion, to return again after rest; or of a sense of bruising, as if one had been badly beaten, which unfits the patient for exercise and forces him to the bed or simply confines him to the house, lolling first on a bed and then on the lounge, seeking comfort under adverse circumstances, as fretful as a cross baby, and demanding more attention than a half dozen ill persons usually require. These attacks usually run a brief course and terminate in the restoration of health. Though it is not uncommon to witness a protracted convalescence, or frequently relapses due to neglect and perverse disregard of the ordinary care of one's self, until finally some intractable condition of ill health is firmly established.

A feverish cold may be marked by the appearance of a group of vesicles on the lips, cheeks, or about the nose; by an ephemeral fever of very high grade, which may go as suddenly as it came, leaving only a temporary exhaustion; by a copious and exhaustive diarrhea, which may establish a locality of lesser resistance to plague the possessor with frequent admonitions of its presence; by a slight cold in the head, altogether too trivial to account for the intensity of the fever; by a fever continuing after the entire disappearance of the local disease; or by some one of a great variety of local manifestations (Seitz) either simultaneous or successive, or which may spring up at intervals, in different localities, and assume various forms. The fever induced by catching cold may run its course unattended with any local manifestations, but after its complete subsidence a local disease may develop.

The catching of cold may be the "fons et origo" of very many indefinable ailments, which mislead both patient and physician. It may be a persistent weariness, a constant feeling of tire, an unremitting sense of feebleness, lessened vigor, mental and nervous perturbations, attended with a depraved appetite, impaired digestion, and faulty nutrition, followed by blood impoverishment and waste, with some one or more of its many, multiform, complex, and erratic phenomena. The sufferer seeks relief at summer resorts or at special cure establishments; by drugging with advertised "cure-alls;" or by running to first one and then another physician. But each attempt in its turn fails, because the cause has remained unrecognized. One physician, mistaking effect for cause, attacks the stomach; another seeks to replenish waste; a third plies the blood with iron and chalybeate waters; and a fourth, of keener acumen than either of his predecessors, traces back, link by link, the long chain of morbid conditions, and finds the cause to have been a puff of air which had come laden with miasma from the river flats, and, true to his instincts, doses with the universal panacea. These years of more or less suffering may be occasionally interrupted by a brief period of repair, the result of some fortunate occurrence, which had drawn the patient for a time away from the coddling care of overzealous friends and the damp and stagnant air of the family dwelling. Thus equipped with better blood, an improved physique, and hopes brightened by the prospects of recovering, the patient returns to the customary home and habits and soon relapses, perhaps even faster than the gains were made, into an equally deplorable if not a worse condition. Another change is sought, probably a voyage across the ocean and a tour through Europe. This chase after health, with its constant change of scenes, places, and habits, but mainly from prolonged absence from the unwholesome domicile, may establish a stand-point not far removed from the level of the miseries from which nature refuses to recede. It may be that with the changing conditions of life health will vibrate between bad and worse until some fortuitous circumstance transforms the habits of life and changes the place of residence, and then the turning-point is reached; or it may be that some magic influence lightens the burden and desolation of long suffering by abruptly separating subject and cause, and life rejoices again in restored health; or it may be that the rays of hope come and go with the transitory improvements of chronic invalidism which progresses through the regular gradations of an incurable and fatal disease. Many fatal heart affections have found their beginning in slight surface coolings, produced by the proximity of damp walls in sleeping apartments, or the cold air ascending from permeable ground floors and foundations. Slight rheumatic pains mark the initial stage, then comes a sharp attack of joint rheumatism, with intense fever and heart complication; later the murmur of valve lesion is heard, faint at first but increasing with time, succeeded by degeneration of the heart muscle, and finally general dropsy with its attendant suffering closes the distressing scene.

Fortunately for many wayward and indiscreet people the detrimental effects of refrigeration are not always so grave, or so disastrous to life. The minor ailments, which are so commonly ascribed to the unavoidable and baneful influence of malarial contamination, most frequently find their cause in the indiscretions of every-day life. Women who are accustomed to all the comforts that wealth can bestow, and who take special care to protect their persons when going to walk or drive, will go to an evening entertainment with bared necks, arms, and heads, with thin boots or slippers, and with insufficient underclothing, in conformity to the usages of society. But even this reprehensible custom would not so often entail pain and disease if ordinary care was exercised during the stay at the place of resort. In the crowded and heated rooms, excited by the congenial companionship of friends and the exhilaratory influences of the general good humor and conviviality, the system becomes a bonfire to the emotional excitement and pleasures. The heart beats fast and faster and the blood is driven with increased rapidity through the distended vessels. The whole surface vascular area is flushed with hot blood. Thus overheated, and perhaps to rest from an animated conversation or a dance, with a glowing and moistened surface, the peripheral vascular system overfilled with hot blood, and a radiating area equal to the entire surface, the unprotected body is suddenly exposed to a draught blowing through an open window or door, or to the colder air of the hall, or even to the open atmosphere, and the vast volume of overheated blood is rapidly chilled and driven back to the interior. Surface heat is lost too rapidly, and the cooled blood, sent back to the overheated organs and tissues, absorbs their heat too rapidly. The bonfire is extinguished, but the embers smoulder in angry recognition of the willful or thoughtless disregard of nature's plainest precepts. Why wonder, then, that colds, coughs, neuralgiæ, catarrhs, digestive disturbances, pains, aches, or some more serious disorder, should torment the devotee of arbitrary fashion and custom? And is it any less surprising that the sufferer should ascribe to nature and nature's methods the cause? The river flats lie in broad expanse along the water front, and marsh miasmata offer a convenient and plausible excuse to cover and hide one's own derelictions.

Men are quite as often guilty of even more flagrant abuses of their constitutions, not only by excessive excitement of purely physiological functions and processes, but by artificial stimulation of the nervous and vascular systems. Alcohol is one of the most diffusible and powerful of the heart stimulants. It accelerates the movement of that organ and increases the frequency of the pulse. By this increased action the blood is driven with greater rapidity through the vessels. The rapid flow of the alcoholized blood to the heat-regulating centers increases heat production, and the temperature of the body is elevated. The surface area of radiation is increased by the greater quantity of blood flowing into and through the distended capillary system. The surface vessels are flooded with overheated and poisoned blood. When to this condition is added the influence of unusual exercise, the ill effect is augmented. With a greatly increased quantity of blood in a greatly increased surface area exposed to a colder medium, heat loss is vastly augmented, and chilling is much more rapid and effective. Such a condition may be produced by a single drink, and certainly will be by frequent potations of alcoholic beverages. Alcohol also poisons the intelligence. The first sense of satisfaction and beatitude is quickly followed by intellectual excitation and hyperideation, which is characterized by lack of moderation, impaired judgment, and loss of will. To these excitant stages others succeed, with which too many men are personally so familiar that mention is unnecessary, beyond the statement that a drunken person loses heat faster, and will freeze sooner, than a sober one. Alcoholism promotes the catching of cold. The combination of poisoned intellect, poisoned heat-regulating centers, stimulated circulation, poisoned blood, and a dilated and over-filled cutaneous vascular system, promotes, facilitates, and augments the chilling influences. It is most frequently and far too often illustrated in the daily life of some men, and but few are willing to acknowledge that either the trivial or graver ailments before referred to ever originate in the pleasures of the cup, but ascribe their cause to the emanations from the river flats, and base their prevention and cure upon the antidotal properties of alcohol. Every bummer in the city and every victim of chronic alcoholism claims to be a sufferer from chronic malarial

poisoning, and it is no unusual circumstance to see a group of them sunning themselves during the ague stage in front of some saloon. But others beside professional bummers delude themselves by this ratiocination. The habitual "diner-out" attributes to malaria the deluge of ideation and nightmares, and the lightning flashes of pain which disturb his rest and make night hideous, and hurls with measured deliberation the usual anathemas against a climate which will not permit rest at ease and refreshing sleep with a stomach overloaded with the good things of life and the blood saturated with the choicest wines. The high liver and overfed man ascribes his stomachic troubles, aching and dizzy head, confused mind, languor, and disinclination to exercise, depressed spirits, and irritable temper, which make all about him unhappy and himself the most miserable of all, to biliousness of miasmatic origin, and cites with intemperate vehemence the salutary effect of a half dozen after-dinner pills and the routine doses of quinia, but he loses sight of the benefit derived from the rest and abstemious diet which an injured and overworked stomach can secure only through much travail and many tribulations. To illustrate the frequency of alleged malarial infection as the cause of sickness which should be attributed to vices of diet, habits, imprudent exposures, or some one or more of a great variety of excesses, I will briefly refer to the cases of four gentlemen from distant and different parts of the country, winter sojourners here for the first time, who were accustomed to the simple habits of prudent people at home, unused to late hours, and strangers to terrapin suppers and the usual accompaniments. One has lived many years in the valley of the Wabash, another near swamps in the Carolinas, a third is from pious New England, where malaria was unknown until the rebellion came, and the fourth has passed the life of a cosmopolitan and has seen malaria so dense that it could be sliced into blocks. All have, many times, had old-fashioned fever and ague, with chills which shook their joints loose and made their hair stand on end, but neither had ever before lived in a climate where malaria followed people in fierce pursuit at every turn during the day, howled under the eaves at night, stole through the stomach, and sneaked in under the nether garments. They are gentlemen of elegant leisure, equipped with ample means and a generous hospitality, and are here for pleasure and intellectual recreation, and to teach the good people how best to make life's cares pass swiftly and merrily. They have, week after week, gone the round of dinners, high teas and suppers, of card parties, theater parties, and æsthetic reunions; and wasted their unoccupied leisure, when other people are toiling, in busy preparation for the succeeding entertainment—one by drenching himself with mineral waters to tone up his stomach, another to clear his head, a third by squeezing his liver with some popular nostrum, and the fourth slumbered under the gaslight that the sunshine might not disturb his reveries in dreamland. This contest of pleasure and excess against physiological endurance has, as is usual, added four to the list of the vanquished, and, notwithstanding the antidotal drink and dose of quinine, each ascribes his present condition to the horrid atmosphere, which custom and habit allege is saturated with malarial emanations from the river flats, even during the season of the year when the temperature is far below the point necessary for the generation of miasmata. Neither will accept the suggestion that the blood alcoholized and overheated, the stomach overladen with food and viands, or the nervous system overstrained by artificial stimulation, bear even a causal relation to the ills which so sorely afflict them. And so thoroughly are they imbued with the popular but erroneous belief, that either would rather go to the grave through years of wretched suffering, penury, and want, or the mad-house, than have health upon the basis of an abstemious and prudent life.

It is not probable that the abuses of human life will ever cease, or that the defective construction of human habitations will ever be wholly prevented, or that the unsanitary conditions of cities will ever be completely cured. Nor is there any natural requirement of life that necessarily entails disease, yet few of those born die by natural decay. To the avoidable causes of disease far the larger number of deaths are due. It is only by the education of the masses in the methods of prevention that the science of medicine can attain its proper position and influence among mankind.